



**UNITED STATES DEPARTMENT OF COMMERCE
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
09/594,638	06/15/00	JAMMY	R 99P7722US <i>gh</i>

MM71/1106
SIEMENS CORPORATION
INTELLECTUAL PROPERTY DEPARTMENT
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EXAMINER	
GHYKA, G	
ART UNIT	PAPER NUMBER
2812	

DATE MAILED: 11/06/01

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary

Application No.

09/594,638

Applicant(s)

JAMMY ET AL.

Examiner

Ghyka

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 13 August 2001.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 18-29 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 18-29 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

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DETAILED ACTION

1. The Applicants' response of 8/13/01 has been entered and made part of the record.

The Applicant's arguments have been fully considered but they are not persuasive for the reasons as discussed below.

Claim Rejections - 35 U.S.C. § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103© and potential 35 U.S.C. 102(f) or (g) prior art under 35 U.S.C. 103(a).

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4. **Claim 18-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kasai et al (EP 0 684 637) in view of Ho et al (US 5,643,823).**

5. Claims 18-29 generally require a trench capacitor comprising a crystalline silicon substrate having a surface formed in the substrate, the surface being substantially free of native oxide; a crystalline silicon nitride layer, formed on the surface of the trench; and an amorphous silicon nitride layer formed on the crystalline silicon nitride layer. Various dependent claims further set for the thicknesses and composition of the layers.

6. Kasai et al discloses the formation of a trench **33** on a semiconductor wafer **31** with the insulative film **32** used as a mask so as to expose single crystal Si on the inner surface of the trench. Next impurity is doped into the exposed single crystal Si and a single crystal doped with impurity is formed on the inner surface of the trench. See column 6, lines 15-25. Kasai et al also disclose the removal of the natural oxide film, and disclose the formation of a thermal nitride film of 2 nm to 5 nm. The thermal nitride film is formed by introducing NH_3 in the chamber at 800 to 1200 degrees Celcius at low pressure. See column 7, lines 1-15. Next a CVD silicon nitride film is formed on the thermal nitride film **35** and the insulative film. See column 8, lines 20-30 and Figure 3.

7. Therefore, the Kasai et al reference differs from the presently claimed invention in that it does not disclose the thermal nitride layer is crystalline.

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8. Ho et al (US 5,643,823) disclose the application of thin crystalline Si_3N_4 liners in shallow trench isolation structures. Ho et al discloses that a high temperature rapid thermal anneal in pure ammonia conducted at 1050 degrees Celcius to 1100 degrees Celcius results in a crystalline silicon nitride film. See the Abstract.

9. One of ordinary skill in the art, at the time of the invention, would have found it obvious to arrive at the presently claimed limitations as it would have been obvious to one of ordinary skill in the art that the thermal nitride of Kasai et al would be in crystalline form, as the Ho et al reference discloses that a silicon nitride film produced by high temperature exposure to ammonia is in crystalline form. Therefore, a *prima facie* case of obviousness has been established.

Response to Applicants' Arguments

10. Applicants argue that Kasai et al discloses the formation of a low pressure thermally deposited film which is amorphous. Applicants argue that a crystalline film or continuous crystalline film is not disclosed or suggested by Kasai. The Examiner maintains that the Applicants arguments are not substantiated by any evidence. The Examiner has admitted that Kasai et al does not explicitly disclose the crystalline form of the nitride layer, and therefore relied on the Ho reference to show that a silicon nitride produced by a high temperature exposure to ammonia, as disclosed by Kasai et al, would be in crystalline form. As stated in the previous Office action it would have been obvious to one of ordinary skill in the art that the thermal nitride of Kasai et al

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would be in crystalline form, as the Ho et al reference discloses that a silicon nitride film produced by high temperature exposure to ammonia is in crystalline form.

11. With respect to the Ho et al reference the Applicants argue that Ho suggests a nitride layer which forms crystallites but is largely amorphous, and relies on column 3, lines 6-11 for support. A more complete reading of the afore mentioned passage indicates that at 1100 degrees Celcius the nitride film is found to be crystalline, while at 1050 degrees Celcius the nitride is largely amorphous. As Kasai et al teaches a temperature range of up to 1200 degrees Celcius the Examiner maintains that it would be obvious to one of ordinary skill in the art that Kasai et al discloses a crystalline nitride layer. With respect to the fact that Ho et al does not remove the oxide layer, the Examiner maintains that Ho et al is simply relied on to show that a nitride layer made by a process of Kasai et al would result in a crystalline nitride layer. Kasai et al clearly discloses the removal of the oxide layer. Therefore, the *prima facie* case of obviousness is maintained.

Conclusion

12. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after

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the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.


13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Alex Ghyka whose telephone number is (703) 305-3407. The examiner can normally be reached on Monday through Friday from 9:30 AM to 6:00 PM.

14. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John F. Niebling, can be reached on (703) 308-3325. The fax phone number for the organization where this application or proceeding is assigned is (703) 308-7722. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

AGG

November 2, 2001

AG


John F. Niebling
Supervisory Patent Examiner
Technology Center 2800